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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/461,158	12/14/1999	ANNE E. MILLER	042390.P6958	3401

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EXAMINER

MACKEY, TERRENCE M

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 04/08/2003

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Applicati n No.

09/461,158

Applicant(s)

MILLER ET AL

Examiner

Terrence Mackey

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1 - 14 and 28 - 33 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) ____ is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. ____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) ____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: ____.

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DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1 – 14 and 28 – 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Farkas et al. (US 6,001,730) in view of Kaufman et al. (US 6,063,306).

Farkas discloses a chemical mechanical polishing slurry useful for polishing copper interconnects. A silicon substrate is provided. A dielectric layer is formed over the substrate. A trench is formed through the dielectric layer (column 4, lines 42-48). A tantalum-based barrier layer is formed within the trench. The tantalum-based barrier layer is one or more of tantalum, tantalum nitride, composites thereof or the like in a preferred form (column 4, lines 49-54). A conductive copper layer is then deposited over a top surface of the barrier layer and within the trench in the dielectric layer (column 4, lines 59-61). This reads on the applicant's limitation of depositing copper over a diffusion barrier and over a top surface of the dielectric layer. The copper layer is then placed into contact with a chemical mechanical polishing slurry. In order to remove copper material from the layer, the slurry forms a thin copper oxide or oxidized layer on top of the copper layer. This reads on the applicant's limitation of forming a

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protective layer over the copper film during polishing. The slurry has a pH of 9.0 to 11.0. The slurry contains 1.0 wt% to 12.0wt% of silica abrasive (column 7, lines 31-40). This reads on the applicant's limitation of polishing the copper layer with a high pH slurry having less than or equal to 10wt% of abrasive.

Unlike the claimed invention Farkas does not teach forming a copper diffusion barrier layer in the trenches.

Kaufman discloses a chemical mechanical polishing slurry useful for polishing a copper/tantalum substrate. Kaufman discloses that tantalum or tantalum alloys can include a layer such as Ta/TaN/Cu (column 4, lines 36-46).

It is the Examiner's position that a person having ordinary skill in the art would have found it obvious to modify Farkas with the method of using a copper diffusion barrier layer as taught by Kaufman since Farkas is not particular about the type of tantalum-based barrier layer used in his process and therefor any tantalum-based barrier layer would have been anticipated in order to produce an expected result.

Response to Arguments

Applicant's arguments received on December 31, 2002, have been fully considered but they are not persuasive.

In traversing the rejection based on Farkas et al. in view of Kaufman et al., the applicant states that Farkas describes two separate and distinct slurries: a first slurry for polishing copper and a second slurry for polishing the tantalum barrier layer. The

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applicant argues that Farkas fails to teach the polishing of a copper layer with a slurry having a high pH and an abrasive in the amount of 10 wt% or less.

The Examiner notes that Farkas discloses that the second slurry polishes both the copper layer and barrier layer. The relative rates for which the copper layer and barrier layer are removed is termed the selectivity and it is important that the selectivity be chosen based upon process factors such as the thickness of the various layers being polished to minimize undesirable dishing of the copper layer.

The Examiner directs the attention of applicant to the second reference of Farkas et al. (US 6,274,478), in particular the disclosure that a slurry substantially similar in concentration and content to that used in a bulk polishing step of a copper layer to form interconnects may be used in a second, slower interfacial polishing step (column 7, lines 5-10).

The Examiner also directs the attention of applicant to the reference of Sasaki et al. (US 5,775,980), in particular the use of a chemical mechanical polishing slurry of 10wt% of silica particles in a dilute aqueous solution of piperazine with pH 11 (column 19, 9-13) for burying a deposited copper film in the trenches to form interconnections.

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period of reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not

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mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication from the Examiner should be directed to Terrence Mackey whose telephone number is 703-305-5504. The Examiner can normally be reached Monday through Friday during the hours of 7:30AM to 4:30PM.

The fax phone numbers for the organization where this application or proceeding is assigned are 703-305-5408 for regular communications and 703-872-9311 for After Final communications.

TMM

March 26, 2003



ROBERT KUNEMUND
PRIMARY EXAMINER